INTERNATIONAL MARITIME ORGANIZATION

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SUB-COMMITTEE ON SAFETY OF NAVIGATION - 45th session
Agenda item 7

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NAVIGATIONAL AIDS AND RELATED MATTERS

Report of the Technical Working Group

Note by the Chairman of the Technical Working Group

1 INTRODUCTION

1.1 As instructed by the Sub-Committee, the Technical Working Group on Navigational Aids and Related Matters met from 20 to 23 July 1998, during the forty-fourth session of the Sub-Committee, under the Chairmanship of Mr. K. Fisher (United Kingdom).

1.2 The following Members, Associate Member and international organizations were represented in the Working Group:

AUSTRALIA
BRAZIL
CANADA
CHILE
DENMARK
FINLAND
FRANCE
GERMANY
GREECE
IRELAND
HONG KONG, CHINA*
ITALY
JAPAN
KOREA
NETHERLANDS
NORWAY
PANAMA
PHILIPPINES
POLAND
RUSSIAN FEDERATION
SINGAPORE
SPAIN
SWEDEN
UNITED KINGDOM
UNITED STATES

INTERNATIONAL HYDROGRAPHIC ORGANIZATION (IHO)
INTERNATIONAL MOBILE SATELLITE ORGANIZATION (Inmarsat)
INTERNATIONAL CHAMBER OF SHIPPING (ICS)
INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)
INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)
INTERNATIONAL FEDERATION OF FREE TRADE UNIONS (ICFTU)
INTERNATIONAL ASSOCIATION OF LIGHTHOUSE AUTHORITIES (IALA)
INTERNATIONAL RADIO-MARITIME COMMITTEE (CIRM)
INTERNATIONAL ASSOCIATION OF INSTITUTES OF NAVIGATION (IAIN)
INTERNATIONAL COUNCIL OF CRUISE LINES (ICCL)

* Associate Member

2 NAVIGATIONAL AIDS AND RELATED MATTERS

Night Vision Equipment

2.1 The Group considered NAV 44/7/1 (Germany), NAV 44/7/7 (United Kingdom) and NAV 41/6/3 (Hong Kong, China) concerning performance standards for Night Vision Equipment for High Speed Craft (HSC) and developed a draft performance standard, given in annex 1.

2.2 This, in particular, had addressed the requirements for range and field of view, and was drafted in a way that was independent of the technology employed such as infra-red or image intensification. it was assumed that IEC and ISO would provide the detailed technical aspects.

2.3 Members were invited to provide their comments and proposals thereon to NAV 45.

Daylight Signalling Lamps

2.4 The Group considered NAV 44/7/2 (Germany) concerning performance standards for Daylight Signalling Lamps and developed a draft performance standard, given in annex 2.

2.5 In paragraph 5.2 of standards chromaticity co-ordinates are provided from the International Commission on Illumination (CEI) Publication No. 2.2, 1975. Members should note that this publication is currently under review in CEI and should stress to CEI that any changes in the co-ordinates will have a considerable effect on the Performance Standards and Conventions of the Organization.

2.6 Members were invited to provide their comments and proposals thereon to NAV 45.

User Requirements for Heading Systems

2.7 The Group noted that there was certain equipment within SOLAS Chapter V and SOLAS Chapter X that may require a true heading input such as Radar, AIS, etc. Heading information may be obtained from a Transmitting Magnetic Heading Device or a Gyrocompass.

2.8 The existing Performance Standards of the Organization give the accuracy required of the Transmitting Magnetic Heading Device and the Gyrocompass. Some of the Performance Standards state the accuracy required by the instruments that use the heading information but some do not. In general there is a need to match the requirements of the "user" instruments with the obtainable accuracies of the devices that supply the heading information.

2.9 The Group prepared the Tables, given in annex 3, as the first analysis of the requirements.

2.10 Members were invited to provide their comments and proposals thereon to NAV 45.

Word-wide Radionavigation System

2.11 The Group recounted the actions given in resolution A.860(20) - Maritime Policy for a Future Global Navigation Satellite System (GNSS). The first action, to be completed by autumn 1999 for input to the 21st Assembly, involved a reassessment of the resolution, if necessary as a result of unforeseen developments on specific proposed future GNSSs.

2.12 The Group was of the opinion that there had been no unforeseen developments and that there was nothing to add at this stage.

2.13 The next action, to be completed by autumn 2001 for input to the 22nd Assembly, involved the consideration of the proposed future GNSS, including the related agreements between interested Governments, other international organizations and/or system providers.

2.14 Members were invited to provide their comments and proposals thereon to NAV 45.

2.15 The Group was informed that there were practical difficulties with Differential Correction Systems in achieving the performance required of resolution A.815(19) - World-wide Radionavigation System, particularly the update rate of 2 s, the signal availability requirement of 99.8% and the service reliability of 99.97%. The Group noted that IALA intends to hold a workshop on GNSS later in the year where these difficulties may be discussed.

2.16 Members were invited to provide their comments and proposals thereon to NAV 45.

3 ACTION REQUESTED OF THE SUB-COMMITTEE

The Sub-Committee is invited to consider this report and decide as appropriate.

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ANNEX 1

DRAFT RESOLUTION MSC ... (...)
(adopted on ... 19---)

PERFORMANCE STANDARDS FOR NIGHT VISION EQUIPMENT FOR HIGH SPEED CRAFT (HSC)

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING ALSO the provisions of Chapter X of the International Convention for the Safety of Life at Sea, 1974, as amended, by which the International Code of Safety for High Speed Craft (HSC Code) was made mandatory,

RECALLING FURTHER the HSC Code (resolution MSC.36(63)) under which the fitting of night vision equipment, as part of the navigational equipment on board HSC, is required,

RECOGNIZING that the use of night vision equipment on board HSC will improve the ship's safety when navigating at night and that the navigational information provided by this equipment constitutes a useful addition of that provided by radar equipment,

BEARING IN MIND the obligation for type approval of night vision equipment according to the HSC Code,

HAVING CONSIDERED the recommendation made by the Sub-Committee on Safety of Navigation at its [...] session,

1. ADOPTS the Recommendation on Performance Standards for Night Vision Equipment for HSC set out in the annex to the present resolution;

2. RECOMMENDS Governments to ensure that night vision equipment fitted in compliance with the HSC Code conform to performance standards not inferior to those specified in the annex to the present resolution.

ANNEX

RECOMMENDATION ON PERFORMANCE STANDARDS FOR NIGHT VISION EQUIPMENT FOR HIGH SPEED CRAFT (HSC)

1 OBJECTIVES OF NIGHT VISION EQUIPMENT FOR HIGH SPEED CRAFT

Night vision equipment facilitates the detection at night of hazards to navigation above the water surface, thus providing essential information to the navigator for collision avoidance and safe navigation of High Speed Craft. Typical hazards to HSC include, for example, small unlit boats, floating logs, oil drums, containers, buoys, ice, hazardous waves and whales.

2 APPLICATION OF THESE PERFORMANCE STANDARDS

These performance standards should be applied to night vision equipment, which is required for HSC pursuant to Chapter 13, paragraph 13.10 of the International Code of Safety for High Speed Craft (HSC Code - resolution MSC 36 (63)).

3 RELATED REQUIREMENTS INVOLVED

The following standards should be additionally applied, as far as applicable:

- Resolution A.694 (17) on General Requirements for Shipborne Radio Equipment forming Part of the Global Maritime Distress and Information System (GMDSS) and for Electronic Navigational Aids;

- Resolution A.813 (19) on General Requirements for Electromagnetic Compatibility (EMC) for all Electrical and Electronic Ship's Equipment;

- IEC Publication 447 "Man-Machine Interface (MMI) - Actuating Principles";

- IEC Publication 945 "Maritime Navigation and Radiocommunication Equipment and Systems - General Requirements, Methods of Testing and Required Test Results";

- IEC Publication 1162 "Maritime Navigation and Radiocommunication Equipment and Systems - Digital Interfaces"; and

- ISO/IEC Publication 9126 "Information Technology, Software Product Evaluation, Quality Characteristics and Guidelines for their Use".

4 DEFINITIONS

"Night vision equipment" means any technical means enabling the position and aspect of objects above the water surface relative to one's own craft to be detected at night.

"High-speed craft" means any craft to which the definition in chapter 1 of the HSC Code applies.

"Standard test target" means a target that simulates the real hazard of a surface object that can be found at sea such as, small unlit boats, floating logs, oil drums, containers, buoys, ice, hazardous waves and whales.

5 FUNCTIONAL REQUIREMENTS

5.1 REQUIRED FUNCTIONS AND THEIR AVAILABILITY

At night, night vision equipment should be capable of detecting objects above the water surface within a certain distance from one's own craft, and of displaying the information pictorially in real time, to assist in collision avoidance and safe navigation.

5.2 RELIABILITY, ACCURACY AND DISCRIMINATION

5.2.1 Continuous operation

Night vision equipment on board HSC, while navigating at sea, should be capable of continuous operation from after sunset until before sunrise. After the equipment has been switched on it should be operational in less than 15 min.

5.2.2 Standard test target

The standard test target should be a black metal target of such a size that when at least 80% is immersed, 1.5 m long x 0.5 m high remains above the water at right angles to the desired direction of detection. Administrations may use other smaller targets to reflect local conditions.

5.2.3 Minimum detection range

With the required field of view, the equipment should detect the standard test target at a minimum of 600 m with a minimum probability of 90%, when the target has been immersed in the sea for at least 24 hours under mean starlight conditions without clouds and without moon.

5.2.4 Field of view

The required horizontal field of view should be at least 20°, 10° on either side of the bow. The vertical field of view should be at least 12° and should be sufficient to enable the equipment to fulfill the performance requirements of this standard as well as being able to see the horizon.

Optionally other fields of view may be provided. The re-selection of the required field of view should be by the action of a single control element.

5.2.5 Pan and tilt ranges of the fields of view

The axis of the field of view should be capable of being moved at least 175° horizontally to either side and minimally 10° downward and 10° upward.

5.2.6 Pan and tilt speeds of the fields of view

By activation of a single control element, the axis of the field of view should be capable of being returned automatically to the ahead position at a minimum angular speed of 30°/s.

5.2.7 Heading indication

When inside the field of view, the heading of the craft should be indicated by a marker on the display with a maximum error not greater than $\pm$ 1°.

A visual indication of relative bearing with a maximum error of $\pm$ 1° should be provided when not pointing forward.

5.2.8 Roll or pitch

The performance of the night vision equipment should be such that when the craft is rolling and/or pitching up to $\pm$ 10° the performance requirements in this standard should be complied with.

5.2.9 Clear view

Arrangement should be provided to ensure efficient cleaning of the sensor head/lens from the operating position.

5.2.10 Interference

The surroundings of objects commonly encountered at sea and in ports should not be displayed less clearly on the monitor of the night vision equipment because of dazzle effects, reflection, blooming, or any other effects.

5.3 MALFUNCTIONS, WARNINGS, ALARMS AND INDICATIONS

Night vision equipment should have the following displays:

.1 state of operation;
.2 visual alarm in the event of failure of the night vision equipment; and
.3 operating hours counter.

5.4 SOFTWARE REQUIREMENTS

If certain functions of night vision equipment are implemented using software, such software should meet the applicable requirements of international [Organizations] standards*.

* Publication IEC 945

6 OPERATIONAL REQUIREMENTS

6.1 ERGONOMY

In the ergonomic design of night vision equipment, the commonly accepted ergonomic standards should be taken into account.

6.2 OPERATIONAL CONTROLS

6.2.1 The number of operational controls should be limited to the minimum required for operation.

6.2.2 Double functions of operational controls should be avoided.

6.2.3 The functions of the individual operational controls should be clearly labelled.

6.2.4 The functions of night vision equipment should be activated directly through the operational controls; menu-driven controls should be avoided.

6.2.5 The operational controls should be clearly identifiable in the dark. Their brightness should be adjustable.

6.2.6 The operational controls of night vision equipment should meet the requirements of resolution A.694(17) as well as applicable requirements of [the International Electrotechnical Commission (IEC)] international standards.*

6.3 PRESENTATION OF INFORMATION

6.3.1 The monitor display should be non-dazzling and non-flickering. The display should be at least 200 mm diameter.

6.3.2 The following information should be displayed permanently on the control panel:

- the selected field of view if more than one is provided.

6.4 SOFTWARE REQUIREMENTS

The operational characteristics of the software should meet the following requirements, in particular:

.1 self-descriptiveness of the functions implemented by means of software;
.2 display of user interface status; and
.3 software protection against unauthorized use.

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* Publication IEC 447

7 DESIGN AND INSTALLATION

7.1 DURABILITY AND RESISTANCE TO ENVIRONMENTAL CONDITIONS

Night vision equipment should withstand the environmental conditions specified in resolution A.694(17) and in the applicable [IEC requirements] international standards.*

7.2 INTERFERENCE

With respect to electrical and electromagnetic interference, night vision equipment should meet the requirements of resolutions A.694(17) and A.813(19) and the applicable [IEC requirements] international standards.*

7.3 POWER SUPPLY

The power supply of night vision equipment should meet the requirements of resolution A.694(17) and the applicable [IEC requirements] international standards.*

7.4 INSTALLATION

7.4.1 Full installation instructions to meet the following requirements should be included in the manual.

7.4.2 The controls of night vision equipment should be installed in the workstation for navigating and manoeuvring, within easy reach of the navigator.

7.4.3 The observation distance from the monitor should not exceed 2.3 times of the monitor diagonal.

7.4.4 The sensor of the night vision equipment should be installed in such a way that:

.1 the required horizontal field of view is free of obstructions;

.2 further within the horizontal panning area of the sensor, in the sector up to 112.5° to either side, there are no obstructions with a deepest shadow bigger than 3°;

.3 two deepest shadows are separated by an unobstructed field of vision of at least 30°;

.4 in a sector from 112.5° to minimally 175°, and from minimally 185° to 247.5°, deepest shadows are kept to a minimum; and

.5 in the required field of view, in the direction right ahead, visibility of the water surface for the vertically tilted sensor is not reduced by more than two ship's lengths by the blind angle of one's own craft.

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* IEC Publication 945

7.4.5 Night vision equipment should be designed and mounted in such a way that its operation and detection functions are not impaired by head wind and/or true wind up to 100 knots and roll and/or pitch angles up to ± 10°.

7.4.6 Its performance data should not be impaired by vibration occurring during normal ship's operation.

7.5 MAINTENANCE

With respect to maintenance, night vision equipment should meet the requirements of resolution A.694(17) and the applicable [IEC requirements] international standards*.

8 INTERFACING

Interfaces should meet applicable international standards**. A video output for image recording should be provided.

9 BACK-UP AND FALL-BACK ARRANGEMENTS

In the event of failure of the pan-tilt device, the sensor should be capable of being fixed in the ahead position.

10 SAFETY PRECAUTIONS

The safety features of night vision equipment should meet the requirements of resolution A.694(17) and the applicable [IEC requirements] international standards.*

11 MARKING AND IDENTIFICATION

11.1 Night vision equipment and any ancillary equipment should be marked clearly and durably with the following data:

.1 identification of the manufacturer;
.2 equipment type number or model identification under which it was type tested; and
.3 serial number of the unit.

11.2 Night vision equipment should additionally be marked in accordance with the requirements of resolution A.694(17) and the applicable [IEC requirements] international standards.*

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* IEC Publication 945

** IEC Publication 1162

12 DOCUMENTATION

Night vision equipment should be delivered complete with its technical documentation. Such documentation should include the following information, if applicable:

General information:

- manufacturer;
- type designation;
- general description of equipment; and
- ancillary equipment and description;

Instructions for installation:

- general installation instructions;
- power supply (voltage, power consumption, frequency) and earthing information.

Operation of equipment:

- description of functions, controls, display;
- description of start-up procedures;
- calibration of equipment and error messages;
- testing capabilities of equipment;
- description of software used and interfaces.

Troubleshooting; maintenance and service:

- special tools required, maintenance material and spare parts (e.g. fuses, spare bulbs);
- equipment care and maintenance on board HSC;
- available services.

Documentation for night vision equipment should also comply with the applicable [IEC requirements*] international standards.*

[13 MISCELLANEOUS

- no requirements]

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* IEC Publication 945

ANNEX 2

DRAFT RESOLUTION MSC...(...)

(adopted on ..... 19..)

PERFORMANCE STANDARDS FOR DAYLIGHT SIGNALLING LAMPS

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of Committee,

RECALLING ALSO the provisions of chapter V of the International Convention for the Safety of Life at Sea, 1974 (SOLAS), chapter 13 of the International Code of Safety for High Speed Craft, 1994 (HSC Code), and chapter X of the Torremolinos International Convention for the Safety of Fishing Vessels, 1977 (Torremolinos Convention), all as amended,

RECOGNIZING that, for safety reasons, daylight signalling lamps are necessary on board for signalling in different situations, e.g. according to COLREG, MERSAR, IMOSAR, and the International Code of Signals,

BEARING IN MIND the obligation for type approval of daylight signalling lamps according to the HSC Code, the Torremolinos Convention, and SOLAS, to ensure operational reliability and suitability, and to ensure a common level of safety,

HAVING CONSIDERED the recommendation made by the Sub-Committee on Safety of Navigation at its [...] session,

1. ADOPTS the Recommendation on Performance Standards for Daylight Signalling Lamps set out in the annex to the present resolution;

2. RECOMMENDS Governments to ensure that daylight signalling lamps fitted in compliance with SOLAS chapter V, the HSC Code and the Torremolinos Convention on or after [.. ..... 20..] conform to performance standards not inferior to those specified in the annex to the present resolution.

ANNEX

RECOMMENDATION ON PERFORMANCE STANDARDS FOR DAYLIGHT SIGNALLING LAMPS

1 OBJECTIVES OF DAYLIGHT SIGNALLING LAMPS FOR CRAFTS

Daylight signalling lamps should be suitable for conveying information between ships, or between ship and shore, by means of light signals, both by day and by night.

2 APPLICATION OF THESE PERFORMANCE STANDARDS

These performance standards should be applied to daylight signalling lamps, which are required for certain ships pursuant to chapter V of the International Convention for the Safety of Life at Sea, 1974, chapter 8 of the International Code of Safety for High Speed Craft, 1994, and chapter X of the Torremolinos International Convention for the Safety of Fishing Vessels, 1977.

3 RELATED REQUIREMENTS INVOLVED

The following standards should be additionally applied, as far as applicable:

- Resolution A.694(17) on General Requirements for Shipborne Radio Equipment forming Part of the Global Maritime Distress and Information System (GMDSS) and for Electronic Navigational Aids;

- Resolution A.813(19) on General Requirements for Electromagnetic Compatibility (EMC) for all Electrical and Electronic Ship's Equipment;

- IEC Publication 945 "Maritime Navigation and Radiocommunication Equipment and Systems-General Requirements, Methods of Testing and Required Test Results"; and

- CIE Publication No. 2.2 "Colors of Light Signals".

4 DEFINITIONS

"**Daylight signalling lamps**" means lamps suitable for transmitting white light signals to an observer by focused light beams which may be fixed on portable.

"**Switch-on time**" means the period of time required for reaching 95% of the required luminous intensity after the daylight signalling lamp has been switched on.

"**Switch-off time**" means the period of time required for luminous intensity to decrease to 5% of the required luminous intensity after the daylight signalling lamp has been switched off.

5 FUNCTIONAL REQUIREMENTS

5.1 REQUIRED FUNCTIONS AND THEIR AVAILABILITY

Daylight signalling lamps should be suitable for giving light signals, which can be clearly distinguished visually as separate signals by an observer.

5.2 RELIABILITY, ACCURACY AND DISCRIMINATION

5.2.1 By day and with an atmospheric transmission of 0.8, the visibility of light signals emitted by daylight signalling lamps should be at least 2 nautical miles, equalling a required luminous intensity of 60,000 cd.

5.2.2 The axial luminous intensity of daylight signalling lamps should reach at least 90% of the maximum luminous intensity.

5.2.3 The luminous intensity of daylight signalling lamps should have its maximum in the centre of the luminous intensity distribution. It should decrease evenly from the centre of luminous intensity distribution.

5.2.4 The half angle of divergence $"_h$ should not exceed 9°, the tenth angle of divergence $"_z$ should not exceed 14°.

5.2.5 The chromaticity of the white signal light should lie within the following corner coordinates of the diagram specified by the International Commission on Illumination (CIE) in CIE Publication No. 2.2, 1975:

x	0.525	0.525	0.452	0.310	0.310	0.443
y	0.382	0.440	0.440	0.348	0.283	0.382

5.2.6 The effective light emission sectors of daylight signalling lamps should be circular. The sum of switch-on and switch-off times should not exceed 500 ms.

5.3 MALFUNCTIONS, WARNINGS, ALARMS AND INDICATIONS

Daylight signalling lamps should be provided with an indication of their operational status.

[5.4 SOFTWARE REQUIREMENTS

- no requirements]

6 OPERATIONAL REQUIREMENTS

6.1 ERGONOMY

Daylight signalling lamps and any battery required for operation should be designed in such a way that safe handling in the intended application is ensured. The daylight signalling lamp should be capable of being operated by personnel wearing gloves.

6.2 OPERATIONAL CONTROLS

The operational controls of daylight signalling lamps should meet the requirements of resolution A.694(17) and the applicable [requirements of the International Electrotechnical Commission (IEC)] international standards.*

[6.3 PRESENTATION OF INFORMATION

- no requirements

6.4 SOFTWARE REQUIREMENTS

- no requirements]

7 DESIGN AND INSTALLATION

7.1 DURABILITY AND RESISTANCE TO ENVIRONMENTAL CONDITIONS

7.1.1 The illuminant should be safely fitted in the daylight signalling lamp; use of screwed sockets should be avoided.

7.1.2 Daylight signalling lamps should be designed in such a way that the illuminant can be easily replaced also in the dark.

7.1.3 The sighting mechanism should be mounted in a fixed attitude, parallel to the optical axis.

7.1.4 All parts of daylight signalling lamps should be made of anti-magnetic material.

7.1.5 Daylight signalling lamps should be so constructed that the accumulation of condensed water is avoided.

7.1.6 The materials used should withstand heat generation during operation.

7.1.7 With respect to durability and resistance to environmental conditions, daylight signalling lamps should meet the requirements specified in resolution A.694(17) and in the applicable [requirements of the IEC] international standards.*

7.2 INTERFERENCE

With respect to electrical and electromagnetic interferences daylight signalling lamps should meet the requirements of resolutions A.694(17) and A.813(19) and the applicable [IEC requirements] international standards.*

* IEC Publication 945

7.3 POWER SUPPLY

7.3.1 Daylight signalling lamps should not be solely dependent upon the ship's main or emergency sources of electrical energy.

7.3.2 Daylight signalling lamps should be provided with a portable battery with a complete weight of not more than 7.5 kg.

7.3.3 The portable battery should have sufficient capacity to operate the daylight signalling lamp for a period of not less than 2 hours.

7.3.4 The power supply of daylight signalling lamps should meet the requirements of resolution A.694(17) and the applicable [IEC requirements] international standards.*

[7.4 INSTALLATION

- no requirements]

7.4 MAINTENANCE

With respect to maintenance, daylight signalling lamps should meet the requirements of resolution A.694(17) and the applicable [IEC requirements] international standards.*

[**8 INTERFACING**

- no requirements]

9 BACK-UP AND FALL-BACK ARRANGEMENTS

Each daylight signalling lamp should be provided with at least three spare illuminants complying with the type-tested illuminant.

10 SAFETY PRECAUTIONS

The outer parts of daylight signalling lamps should not reach temperatures during operation which restrict their manual use. Additionally, daylight signalling lamps should meet the safety requirements of resolution A.694(17) and the applicable [IEC requirements] international standards.*

11 MARKING AND IDENTIFICATION

11.1 Daylight signalling lamps should be marked clearly and durably with the following data:

- identification of the manufacturer;
- equipment type number or model identification under which it was type tested; and
- serial number of the unit.

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* IEC Publication 945

11.2 On the illuminant, the manufacturer's label and the voltage and power consumption should be marked clearly and durably.

11.3 Daylight signalling lamps should further be marked in accordance with the requirements of resolution A.694(17) and the applicable [IEC requirements] international standards.*

12 DOCUMENTATION

Daylight signalling lamps should be delivered complete with their technical documentation. Such documentation should include the following information, if applicable:

General information :

- manufacturer;
- type designation;
- general description of the equipment;
- ancillary equipment and description;

Instructions for operation of equipment:

- general information on mains connection;
- power supply data (voltage, power consumption);
- description of start-up procedures;
- description of ways of checking the parallel adjustment of sighting mechanism and luminous intensity axis;

Troubleshooting; maintenance and service :

- description of illuminant replacement;
- description of adjustment of sighting mechanism;
- special tools required, maintenance material and spare parts (e.g. spare illuminants, fuses, mirrors and covers);
- equipment care and maintenance on board;
- available services.

Documentation for daylight signalling lamps should additionally comply with the applicable [IEC requirements] international standards.*

[13 MISCELLANEOUS

- no requirements]

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* IEC Publication 945

ANNEX 3

TABLE OF HEADING REQUIREMENTS

SOLAS CHAPTER V

SOLAS Chapter V Regulation 20	**1.2.1**	**1.2.4**	**1.3**	**1.4**	**1.5.5**	**1.6**	**1.8**	**1.10**
Application	All ships	All ships	Below 150 gross tonnage	$ 150 gross tonnage	$ 300 gross tonnage	$ 500 gross tonnage	$ 3000 gross tonnage	$ 10,000 gross tonnage
Requirement	Ships heading	Compass bearing	Administration decision	Ships heading	Radar, EPA, AIS	ATA	2ND radar, ARPA, heading or track control	Track controller
Equipment	Magnetic compass or other means	–	–	Magnetic compass or other means	[TMHD] ?			
IMO Resolution	A.382			A.382	To be developed	A.424	A.424	A.424
Static accuracy	2.2.(A.382 -< 0,5°							
Dynamic accuracy	5.3 (A.382) - ± 1°				1.5.1 Radar ± ½° 1.5.2 EPA ± 1° 1.5.4 AIS ± 1°	1.6.5 [± **a** °]	Radar ± ½° ARPA ± **a** ° Heading/track controller ± 1°	[Track controller ± 1°]
Environment	5.1 - 5.3(A.382) Rate of turn 1.5°/s 5.1 - Temperature 20°C ± 3° C				Rate of turn 12°/s Roll/pitch ± 10° Temperature + 50° C to - 25° C	Rate of turn 12°/s Roll/pitch ± 10° Temperature + 50° C to - 25° C Latitude 70° N/S	Rate of turn 12°/s Roll/pitch ± 10° Temperature + 50° C to - 25° C Latitude 70° N/S	Rate of turn 12°/s Roll/pitch ± 10° Temperature + 50° C to - 25° C Latitude 70° N/S
Power supply	None	None						

HIGH SPEED CRAFT

SOLAS CHAPTER X (CHAPTER 13 OF THE HSC CODE)

HSC CODE CHAPTER 13	**13.2.1**	**13.2.5**	**13**
Application	All vessels	#100 passengers	> 100 passengers
Requirement	Ship's heading	Radar, ATA	Radar, ATA, Autopilot, NVEE
Equipment	Magnetic compass	[TMHD] ?	Gyro
IMO Resolution	A.382	To be developed	A.821
Static accuracy	2.2 of A.382 - < 0.5°		
Dynamic accuracy	5.3 of A.382 - ± 1°	13.5.1 Radar ± ½° 13.5.3 [ATA] ± **a**°	13.5.1 Radar/2nd radar ± ½° 13.5.3 ATA ± **a**° 13.12 Autopilot ± 1° 13.? NVEE ± 2°
Environment	Rate of turn 20°/s Roll/Pitch ± 10° 70 knots Latitude 70° N/S Temperature + 50° C to - 25° C	As 13.2.1	As 13.2.1 + additional dynamic condictions in A.821
Power supply	None		

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